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Tijeras-Cañoncito fault system, Galisteo section (Class A) No. 2033a

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Compiled in cooperation with the New Mexico Bureau of Geology & Mineral Resources

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Synopsis	**General:** Right-lateral slip probably occurred on the Tijeras-Cañoncito fault system during the Laramide orogeny. Structural data suggest left-lateral Neogene displacement occurred on the fault, which is consistent with east-west extension of the Rio Grande rift and the fault's northeasterly strike. Surface rupture of middle to late Quaternary sediments along the southwestern (Canyon) section of the fault at Adobe Camp is interpreted from site-specific study. Other displaced Quaternary deposits have been identified along the southwestern section of the fault on Kirtland Air Force Base and in Tijeras Canyon. The fault apparently

	controls near-surface groundwater conditions on Kirtland Air Force Base. **Sections:** This fault has 2 sections. Lisenbee and others (1979 #1725) separated the Tijeras-Cañoncito fault system into five sections on the basis of structural style, fault trace complexity, and sense and amount of separation. Wong and others (1995 #1155) informally named these the Lamy, San Pedro/Ortiz, Monte Largo, Tijeras, and Four Hills sections; Wong and others (1995 #1155; 1996 #1156) assumed that the two southernmost sections (the Four Hills and Tijeras sections) are active based on evidence of Quaternary faulting noted by Lisenbee and others (1979 #1725) and GRAM, Incorporated and William Lettis & Associates, Incorporated (1995 #1430). Later findings show that there has been Quaternary activity on the Monte Largo section (Abbott and Goodwin, 1995 #1729; Kelson and others, 1997 #1781), but there is still no evidence that suggests Quaternary activity north of Golden. Stearns (1953 #1127) and Bachman (1975 #1283) map faulted early Tertiary gravel north of Golden but show no faulting of Pleistocene gravel along traces of the fault system. Thus, there are insufficient data to address the activity of the fault system north of Golden (i.e., along the San Pedro/Ortiz and Lamy sections). The fault system herein is subdivided into two sections that group sections previously identified (Lisenbee and others, 1979 #1725; Wong and others, 1995 #1155, 1996 #1156). The boundary between the two sections is inferred to be near Golden, i.e., at the boundary between the Monte Largo and San Pedro/Ortiz sections of Wong and others (1995 #1155; 1996 #1156). This boundary also coincides with the intersection of the Tijeras fault and the La Bajada fault [2032] and a cluster of contemporary microseismicity noted by House and Hartse (1995 #1160).
Name comments	**General:** The regionally extensive Tijeras-Cañoncito fault system consists of several northeast-striking, subvertical faults, including the Tijeras, Gutierrez, Zuzax, San Lazarus, Los Angeles, and Lamy faults (Lisenbee and others, 1979 #1725; Woodward, 1984 #1735; Maynard and others, 1991 #1732; Abbott and Goodwin, 1995 #1729). The fault system commonly is referred to as the "Tijeras fault zone", but the name Tijeras-Cañoncito fault system is retained herein to denote the entire group of faults. The fault system (or parts thereof) have been mapped by Bachman (1975 #1283), Kelley and Northrop (1975 #1308), Booth (1977 #1733), Kelley (1977 #1106), Lisenbee and others (1979 #1725), Connolly (1982 #1726), Woodward (1984 #1735), Maynard and

	others (1991 #1732), Karlstrom and others (1994 #7517), Abbott and Goodwin (1995 #1729), Abbott and others (1995 #1769), GRAM, Incorporated and William Lettis & Associates, Incorporated (1995 #1430), Maynard (1995 #1728), Ferguson and others (1996 #7256), Chamberlin and others (1997 #1768), Connell (1997 #1765), Read and others (1998 #7523), Ferguson and others (1999 #7551), Lisenbee (1999 #7518), Lisenbee and Maynard (2002 #7520), Maynard (2002 #7521), and Maynard and others (2002 7522). The fault system extends from an intersection with the Picuris-Pecos fault [2023] near Lamy, about 22 km southeast of Santa Fe, to an intersection with the Sandia [2037] and Hubbell Spring [2120] faults in the Four Hills area, about 16 km southeast of Albuquerque. **Section:** The Galisteo section is herein informally named after the small village along Highway 41, about 32 km south of Santa Fe. This section includes the Lamy and San Pedro/Ortiz sections identified by Wong and others (1995 #1155; 1996 #1156). The Galisteo section extends from an intersection with the Picuris-Pecos fault [2023] near Lamy, to an intersection with the La Bajada fault [2032] near Golden. Detailed mapping along this fault section includes 1:24,000-scale maps by Lisenbee (1999 #7518), Lisenbee and Maynard (2002 #7520), Maynard (2002 #7521), and Maynard and others (2002 #7522).
County(s) and State(s)	SANTA FE COUNTY, NEW MEXICO
Physiographic province(s)	BASIN AND RANGE
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* The location of the fault is based on 1:24,000-scale mapping by Lisenbee (1999 #7518), Lisenbee and Maynard (2002 #7520), Maynard (2002 #7521), and Maynard and others (2002 #7522).
Geologic setting	The Tijeras-Cañoncito fault system forms the structural boundary between the Española basin of the Rio Grande rift to the west and the Great Plains tectonic province to the east. The fault system has a history of recurrent movement, including Late Pennsylvanian-Early Permian displacement (Lisenbee and others, 1979 #1725), renewed activity during the late Cretaceous-early

	Tertiary Laramide orogeny (Cather, 1992 #1773; Lisenbee 2013 #7519), and Neogene displacement associated with east-west extension of the Rio Grande rift (Keller and Cather, 1994 #1731; Abbott and Goodwin, 1995 #1729). In addition, the fault system is associated with a series of Oligocene intrusive rocks of the San Pedro-Ortiz porphyry belt (Maynard and others, 1991 #1732). The fault traverses the epicentral area of the 1918 Cerrillos earthquake, the largest (ML 4.5 to 5.5) historical earthquake in the northern Rio Grande rift (Olsen, 1979 #1724), and may be associated with a moderate (ML 4.5) earthquake that rattled the towns of San Antonito and Zamora in 1947 (Sanford, 1976 #1734).
Length (km)	This section is 37 km of a total fault length of 79 km.
Average strike	N49°E (for section) versus N46°E (for whole fault)
Sense of movement	Left lateral *Comments:* Post-Upper Cretaceous left separation of about 5 km is noted by Maynard (1995 #1728), although he also notes that the net amount and direction of true slip is unknown because of a lack of piercing points on the fault surface. There was left-lateral separation during the Neogene, based on regional geologic relations (Abbott and others, 1995 #1769) and structural data collected on the Canyon fault section [2033b] by Abbott and Goodwin (1995 #1729). No piercing points have been documented along the Galisteo section of the fault system.
Dip Direction	V *Comments:* Deep subsurface data are lacking for this fault section. Maynard (1995 #1728) provides detailed shallow geologic data that constrain a vertical fault zone within the upper 0.5 km of the crust. Lisenbee and others (1979 #1725), Kelley and Northrop (1975 #1308), and Abbott and others (1995 #1769) note that the fault system is subvertical, exhibits evidence of predominantly lateral slip during the Neogene, and has a linear trace across linear topography. Based on these relations, Wong and others (1995 #1155) assign a range of 80° E. to 80° W. with a preferred dip of 90° (vertical) for modeling purposes.
Paleoseismology studies	

Geomorphic expression	Linear valleys are present along the fault trace within the Ortiz Mountains, but no prominent fault-related lineaments have been noted by previous workers along the Galisteo fault section. Overall, this suggests that the Galisteo fault section has little or no geomorphic expression related to late Quaternary fault movement.
Age of faulted surficial deposits	Post-early Tertiary displacement along the Galisteo section is indicated by faulting of Oligocene volcanics in the Ortiz Mountains (Schutz, 1995 #1727; Maynard, 1995 #1728) and early Tertiary Galisteo Formation between the Ortiz Mountains and Lamy (Stearns, 1953 #1127; Bachman, 1975 #1283).
Historic earthquake	
Most recent prehistoric deformation	undifferentiated Quaternary (<1.6 Ma) *Comments:* The timing of the most-recent earthquake on the Galisteo fault section is unknown. In the absence of data on the timing of displacement, Quaternary movement is interpreted based on structural continuity between the Galisteo and Canyon fault sections.
Recurrence interval	
Slip-rate category	Less than 0.2 mm/yr *Comments:* There are no well constrained data on the Quaternary slip rate of the Tijeras-Cañoncito fault system. Wong and others (1995 #1155; 1996 #1156) estimated a range in slip rates of 0.02–0.72 mm/yr and a preferred rate of 0.09 mm/yr, based on regional analysis of slip rates within the Rio Grande rift. Slip-rate category assigned based on Wong and others' (1995 #1155; 1996 #1156) preferred rate.
Date and Compiler(s)	2016 Keith I. Kelson, William Lettis & Associates, Inc. Andrew P. Jochems, New Mexico Bureau of Geology & Mineral Resources
References	#1729 Abbott, J.C., and Goodwin, L.B., 1995, A spectacular exposure of the Tijeras fault, with evidence for Quaternary motion, *in* Bauer, P.W., Kues, B.S., Dunbar, N.W., Karlstrom, K.E., and Harrison, B., eds., Geology of the Santa Fe region, New Mexico: New Mexico Geological Society, 46th Field Conference,

September 27–30, 1995, Guidebook, p. 117–125.

#1769 Abbott, J.C., Cather, S.M., and Goodwin, L.B., 1995, Paleogene synorogenic sedimentation in the Galisteo basin related to the Tijeras-Cañoncito fault system, *in* Bauer, P.W., Kues, B.S., Dunbar, N.W., Karlstrom, K.E., and Harrison, B., eds., Geology of the Santa Fe region, New Mexico: New Mexico Geological Society, 46th Field Conference, September 27–30, 1995, Guidebook, p. 271–278.

#1283 Bachman, G.O., 1975, Geologic map of the Madrid quadrangle, Santa Fe and Sandoval Counties, New Mexico: U.S. Geological Survey Geologic quadrangle Map GQ-1268, 1 sheet, scale 1:62,500.

#1733 Booth, F.O., III, 1977, Geologic map of Galisteo Creek area, Lamy to Cañoncito, Santa Fe County, New Mexico: U.S. Geological Survey Miscellaneous Field Studies Map MF-823, 2 sheets, scale 1:12,000.

#1773 Cather, S.M., 1992, Suggested revisions to the Tertiary tectonic history of north-central New Mexico, *in* Lucas, S.G., Kues, B.S., Williamson, T.E., and Hunt, A.P., eds., San Juan basin IV: New Mexico Geological Society, 43rd Field Conference, September 30–October 3, 1992, Guidebook, p. 109–122.

#1768 Chamberlin, R.M., Karlstrom, K.E., Connell, S.D., Brown, C., Nyman, M., Hitchcock, C., Kelson, K.I., Noller, J., Sawyer, T., Cavin, W.J., Parchman, M.A., Cook, C., and Sterling, J., 1997 (revised 2002), Geology of the Mount Washington quadrangle, Bernalillo and Valencia Counties, New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File Geologic Map 8, scale 1:24,000.

#1765 Connell, S.D., 1997, Cenozoic geology of the Tijeras 7.5-minute quadrangle, Bernalillo County, central New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File OF-425, 11 p. pamphlet, 1 sheet, scale 1:24,000.

#1726 Connolly, J.R., 1982, Structure and metamorphism in the Precambrian Cibola gneiss and Tijeras greenstone, Bernalillo County, New Mexico, *in* Callender, J.F., ed., Albuquerque country II: New Mexico Geological Society, 33rd Field Conference, November 4–6, 1982, Guidebook, p. 197–202.

#7551 Ferguson, C.A., Osburn, G.R., and Allen, B.D., 1999, Geologic map of the San Pedro 7.5-minute quadrangle, Bernalillo, Sandoval, and Santa Fe Counties, New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File Geologic Map 29, scale 1:24,000.

#7256 Ferguson, C.A., Timmons, J.M., Pazzaglia, F.J., Karlstrom, K.E., Osburn, G.R., and Bauer, P.W., 1996, Geology of the Sandia Park 7.5-minute quadrangle, Bernalillo and Sandoval counties, New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File Geologic Map - 1.

#1430 GRAM, Incorporated and William Lettis & Associates, Incorporated, 1995, Conceptual geologic model of the Sandia National Laboratories and Kirtland Air Force Base: Technical report to Sandia National Laboratories, Albuquerque, New Mexico, December 1995, 15 pls.

#1160 House, L., and Hartse, H., 1995, Seismicity and faults in northern New Mexico, *in* Bauer, P.W., Kues, B.S., Dunbar, N.W., Karlstrom, K.E., and Harrison, B., eds., Geology of the Santa Fe region, New Mexico: New Mexico Geological Society, 46th Field Conference, September 27-30, 1995, Guidebook, p. 135–137.

#7517 Karlstrom, K.E., Kirby, E., Connell, S., Read, A., Ferguson, C., Osburn, G., Ilg, B., Abbott, J., Bauer, P., Ralser, S., and Love, D., 1994, Geology of the Tijeras quadrangle, Bernalillo County, New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File Geologic Map 4, scale 1:24,000.

#1731 Keller, G.R., and Cather, S.M., eds., 1994, Basins of the Rio Grande rift—Structure, stratigraphy, and tectonic setting: Geological Society of America Special Paper 291, 304 p.

#1106 Kelley, V.C., 1977, Geology of Albuquerque basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources Memoir 33, 60 p., 2 pls.

#1308 Kelley, V.C., and Northrop, S.A., 1975, Geology of Sandia Mountains and vicinity, New Mexico: New Mexico Bureau of Mines and Mineral Resources Memoir 29, 136 p., 4 pls., scale 1:48,000.

#1781 Kelson, K.I., Hitchcock, C.S., and Harrison, J.B.J., 1997, Paleoseismologic assessment of the Tijeras fault, central New Mexico: Technical report to U.S. Geological Survey, under Contract 1434-HQ-97-G-03012, 3 p.

#7518 Lisenbee, A.L., 1999, Geologic map of the Galisteo quadrangle, Santa Fe County, New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File Geologic Map 30, scale 1:24,000.

#7519 Lisenbee, A.L., 2013, Multi-stage Laramide deformation in the area of the southern Santa Fe embayment (Rio Grande rift), north-central New Mexico, *in* Hudson, M.R., and Grauch, V.J.S., eds., New perspectives on Rio Grande rift basins—From tectonics to groundwater: Geological Society of America Special Paper 494, p. 239–260.

#7520 Lisenbee, A.L., and Maynard, S.R., 2002, Geologic map of the Captain Davis Mountain 7.5-minute quadrangle, Santa Fe County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 48, scale 1:24,000.

#1725 Lisenbee, A.L., Woodward, L.A., and Connolly, J.R., 1979, Tijeras-Cañoncito fault system—A major zone of recurrent movement in north-central New Mexico, *in* Ingersoll, R.V., Woodward, L.A., and James, H.L., eds., Guidebook of Santa Fe country: New Mexico Geological Society, 30th Field Conference, October 4-6, 1979, Guidebook, p. 89–99.

#1728 Maynard, S.R., 1995, Gold mineralization associated with mid-Tertiary magmatism and tectonism, Ortiz Mountains, Santa Fe County, New Mexico, *in* Bauer, P.W., Kues, B.S., Dunbar, N.W., Karlstrom, K.E., and Harrison, B., eds., Geology of the Santa Fe region, New Mexico: New Mexico Geological Society, 46th Field Conference, September 27-30, 1995, Guidebook, p. 161–166.

#7521 Maynard, S.R., 2002, Geologic map of the Golden 7.5-minute quadrangle, Santa Fe County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 36, scale 1:24,000.

#7522 Maynard, S.R., Lisenbee, A.L., and Rogers, J., 2002, Geologic map of the Picture Rock 7.5-minute quadrangle, Santa

Fe County, New Mexico: New Mexico Bureau of Geology and Mineral Resources Open-File Geologic Map 51, scale 1:24,000.

#1732 Maynard, S.R., Woodward, L.A., and Giles, D.L., 1991, Tectonics, intrusive rocks, and mineralization of the San Pedro—Ortiz porphyry belt, north-central New Mexico, *in* Julian, B., and Zidek, J., eds., Field guide to geologic excursions in New Mexico and adjacent areas of Texas and Colorado: New Mexico Bureau of Mines and Mineral Resources Bulletin 137, p. 57–69.

#1724 Olsen, K.H., 1979, The seismicity of north-central New Mexico with particular reference to the Cerrillos earthquake of May 28, 1918, *in* Ingersoll, R.V., Woodward, L.A., and James, H.L., eds., Guidebook of Santa Fe country: New Mexico Geological Society, 30th Field Conference, October 4-6, 1979, Guidebook, p. 65–75.

#7523 Read, A.S., Allen, B.D., Osburn, G.R., Ferguson, C.A., and Chamberlin, R., 1998, Geology of Sedillo quadrangle, Bernalillo County, New Mexico: New Mexico Bureau of Mines and Mineral Resources Open-File Geologic Map 20, scale 1:24,000.

#1734 Sanford, A.R., 1976, Seismicity of the Los Alamos region based on seismological data: Los Alamos Scientific Laboratory Informal Report LA-6416-MS, 9 p.

#1727 Schutz, J.L., 1995, Gold mineralization associated with alkaline intrusives at the Carache Canyon breccia pipe prospect, Ortiz Mountains, New Mexico, *in* Bauer, P.W., Kues, B.S., Dunbar, N.W., Karlstrom, K.E., and Harrison, B., eds., Geology of the Santa Fe region, New Mexico: New Mexico Geological Society, 46th Field Conference, September 27-30, 1995, Guidebook, p. 167-173.

#1156 Wong, I., Kelson, K., Olig, S., Bott, J., Green, R., Kolbe, T., Hemphill-Haley, M., Gardner, J., Reneau, S., and Silva, W., 1996, Earthquake potential and ground shaking hazard at the Los Alamos National Laboratory, New Mexico, *in* Goff, F., Kues, B.S., Rogers, M.A., McFadden, L.D., and Gardner, J.N., eds., The Jemez Mountains region: New Mexico Geological Society, 47th Field Conference, September 25-28, 1996, Guidebook, p. 135–142.

#1155 Wong, I., Kelson, K., Olig, S., Kolbe, T., Hemphill-Haley,

	M., Bott, J., Green, R., Kanakari, H., Sawyer, J., Silva, W., Stark, C., Haraden, C., Fenton, C., Unruh, J., Gardner, J., Reneau, S., and House, L., 1995, Seismic hazards evaluation of the Los Alamos National Laboratory: Technical report to Los Alamos National Laboratory, Los Alamos, New Mexico, February 24, 1995, 3 volumes, 12 pls., 16 appen. #1735 Woodward, L.A., 1984, Basement control of Tertiary intrusions and associated mineral deposits along Tijeras-Cañoncito fault system, New Mexico: Geology, v. 12, p. 531–533.